Met Office

AtlantOS
Optimising and Enhancing the Integrated Atlantic Ocean Observing Systems

Assimilating synthetic Biogeochemical-Argo data into a global ocean model to inform observing system design

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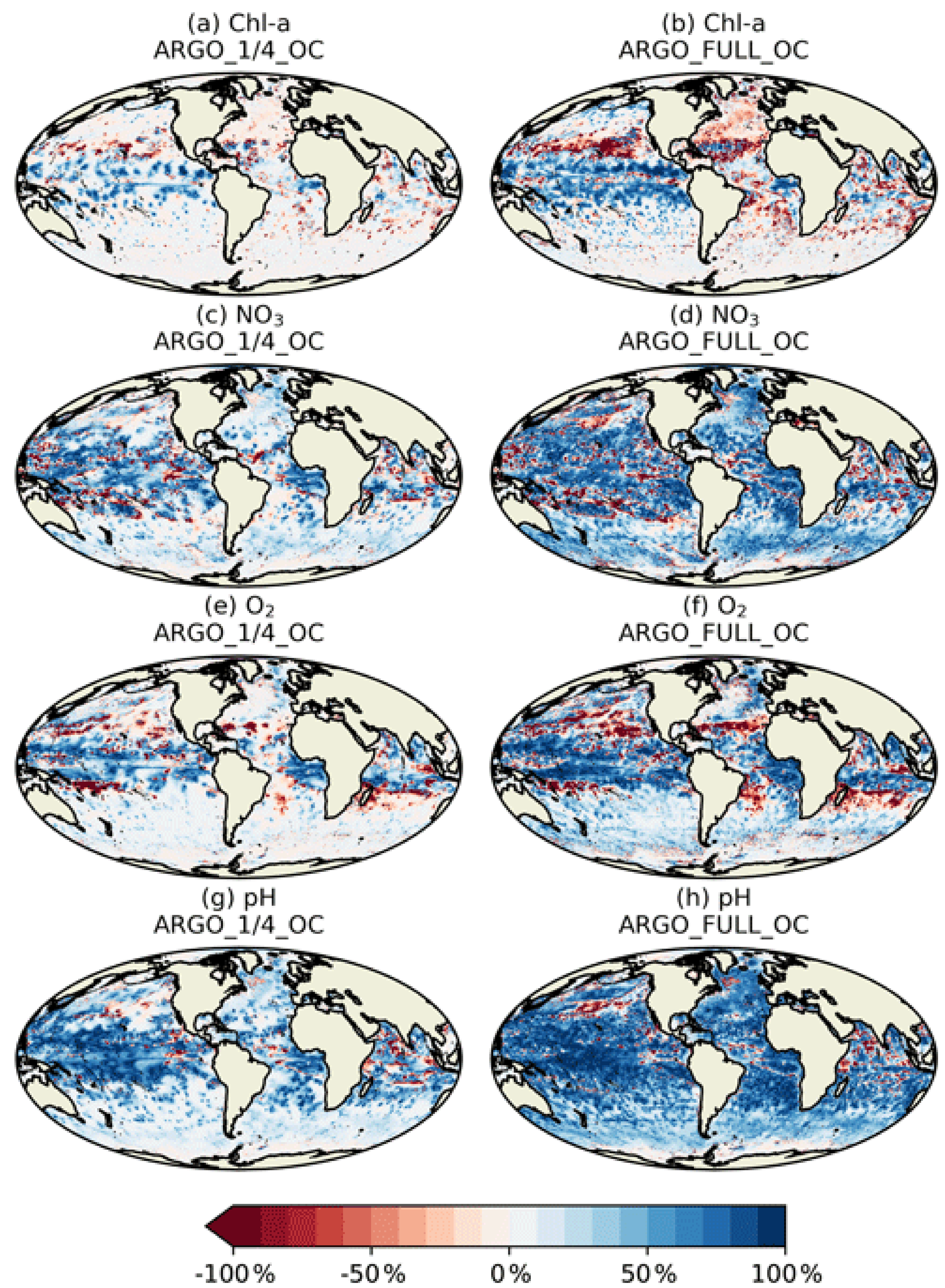
Conclusions

- Observing system simulation experiments (OSSEs) show potential impact of assimilating BGC-Argo
- Target array of 1000 floats will provide clear benefits
- More floats could give even better results
- Assimilation developments needed to maximise impact
- Ford, 2021, Biogeosciences, 10.5194/bg-18-509-2021

Methods

- Model: NEMO-CICE-MEDUSA, 1/4° global
- Assimilation: NEMOVAR (3D-Var FGAT)
- Observations assimilated: chlorophyll (ocean colour), chlorophyll, nitrate, oxygen, pH (BGC-Argo)
- Experiments: fraternal twin
  - Nature run (NR) provides “truth”
  - Observations sampled from NR with errors added
  - Assimilated into perturbed version of model
  - Assess extent to which “truth” is recovered
- Runs:
  - Ocean colour (OC) only – current observing system
  - OC + 1000 BGC-Argo floats – target
  - OC + 4000 BGC-Argo floats – theoretical



Percentage change (blue = better) in median absolute error at 100m depth when assimilating OC + BGC-Argo compared with OC only.
Left: 1000 floats, right: 4000 floats
Top to bottom: chlorophyll, nitrate, oxygen, pH

Results

- Ocean colour effectively constrains surface chlorophyll
- BGC-Argo improves vertical structure and deep chlorophyll maximum
- BGC-Argo improves assimilated variables throughout water column
- BGC-Argo improves air-sea CO_2 flux
- 1000 floats gives good results, 4000 floats gives better results
- Better use of 1000 float array could be made by improving assimilation

Future work

- Develop ways to better use sparse observations (e.g. length scales, EOFs, hybrid ensemble-var)
- Multivariate balancing
- Apply to real-world observations to create reanalysis

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